

Shanghai from Dense Mono-center to Organic Poly-Center Urban Expansion¹

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Abstract:

Shanghai is one of the largest prosperous cities in China with the population over 17million. From the 1940's the major urban planning strategy is trying to de-centralize the overcrowded population in the central part of the city, where the density was even as high as 70000 people/sq.km, now decreased to 40000 people/sq.km. The still very high dense city contributes relative less motorized travel, as over 50% of people travel by foot and bike. But it also creates the problem of congestion in the city center, degenerated quality. And the rapid growth claims more space to accommodate more diversity and dynamic economic activities. The tendency shows Shanghai should transfer its spatial structure from Mono-center to Poly center. But the de-centralization strategy to encourage the people stay in the satellite town has not been success. Recently the municipal government has put great attention to support the secondary city in the suburb of Shanghai, according to the plan the most important three new towns will be with the population of one million. More and more industry has also been moved out to the suburb due to the lower cost for land and convenient for freight transport. In the year 2010, the world expo will be held in shanghai, some major infrastructure is now under-construction, which including the 400km metro system, and several the major passenger interchanges, all those will have a big influence on the spatial structure of Shanghai Region. The transformation of shanghai urban planning policy and the vision of the urban spatial structure will be analyzed in this paper.

Keywords: urban planning, poly-center urban expansion, transportation, Shanghai

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1. Introduction

Shanghai is one of the world's great cities. It is located on the East China coast just to the south of the mouth of the Yangtze River, at the junction of the east coastal economic belt and the Yangtze River Basin economic belt. It has jurisdiction over 18 districts and one island county, with a total area of 6,340.5 sq.km, including 523 sq.km for Pudong New Area.



Fig.1 Shanghai Location Map

Due to constant inflow of people from other parts of the country, the size of population in Shanghai keeps growing. At the beginning when Shanghai was turned into a city, it only had a population of less than 100,000. By the time Shanghai was liberated in 1949, the city had a population of only 5.2 million. By the end of 2004, however, Shanghai's population of residents with permanent resident papers had grown to 13.5239 million, representing 1% of China's total. The population of long-term residents reached 17.42 million, 310,000 more than in the previous year

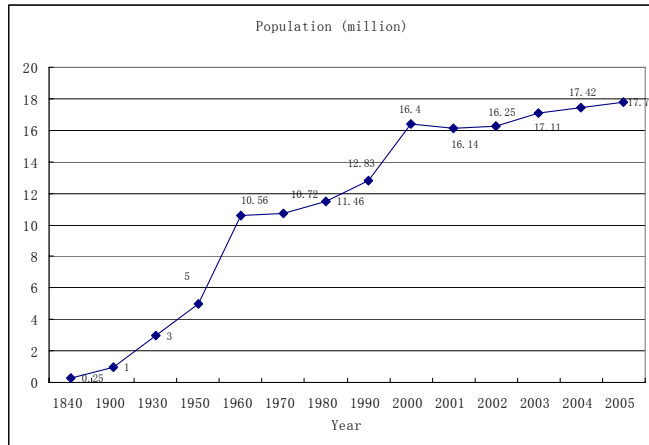


Fig. 2 Population In Shanghai

Since the Chinese government adopted the reform and opening policy in 1978, Shanghai has witnessed marked progresses in its social and economic development. Today, Shanghai is the largest economic and transportation center in China. Now, the city is striving to turn itself into one of the economic, financial, trade and transportation centers in the world. It also aims to lead the country in building a well-off society and in achieving the initial modernization. Now tremendous achievements have been made in economic construction. From 1990, the growth rate of Shanghai's GNP was around 10 percent for more than thirteen years in succession. In year 2004, GDP reached 745.027 billion yuan, with an annual growth rate of 13.6 percent; and per capita GDP stood at US\$6,700 calculated according to the year's exchange rate, equivalent to the level of medium-advanced countries.

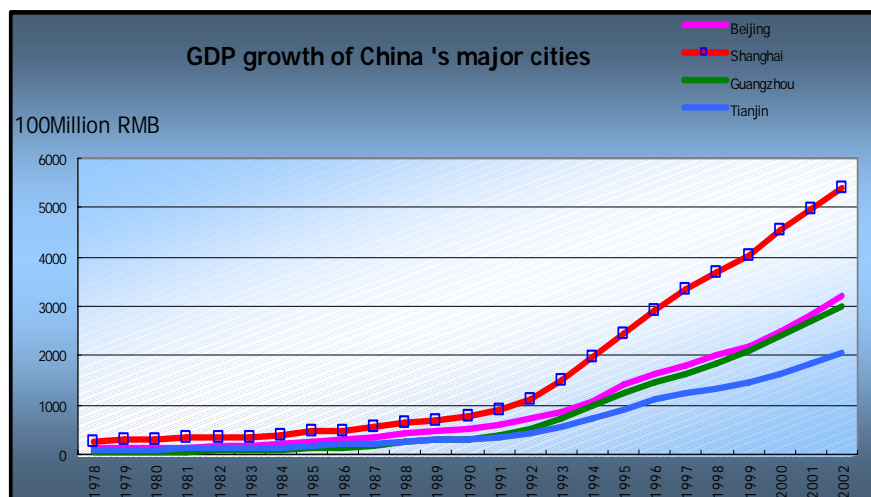


Fig.3 The economic growth of major cities in china

With the contrast to the economic development, the infrastructure was far lagged behind urban and industry development. From 1950 to 1978 in almost thirty years the total investment in infrastructure was only 6 billion. In the

year 1990 the road space per capita was 4.55 sq.m, in the central area only 2.29 sq.m. Long distance travel used to be very difficult, so that people prefer to stay in the city center where the service facility is in a walking distance.

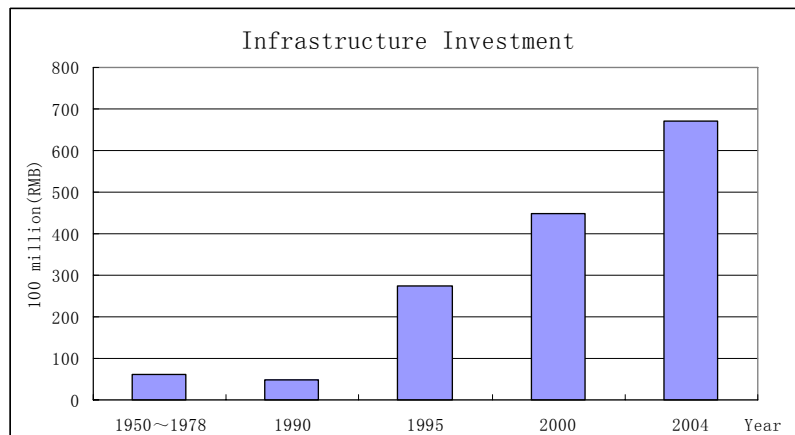


Fig.4 Infrastructure Investment in Shanghai

It is noticed that one of the distinct characterizes of Shanghai is the high urban density and quite intensively mixed land-uses in the central build-up area. Forexample the south quarter which is the core area of Shanghai city covers an area of 46.05sq-km with population of 2.7million. Each person only occupies 17.04 sq.m land space. The density of the densest part even reached to 1480 person/ha.

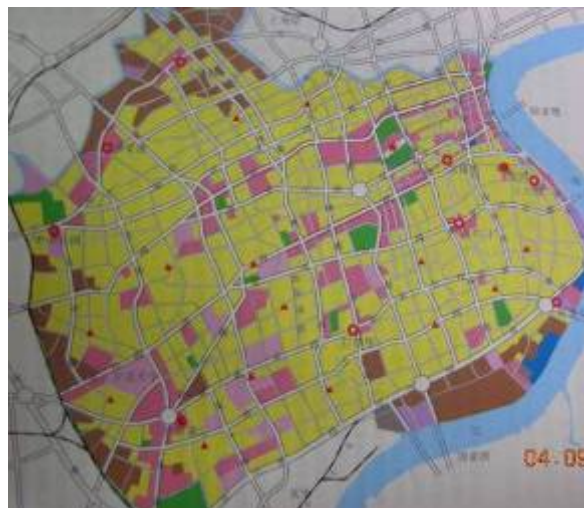


Fig. 5 The South Quarter Plan (1990)ⁱ

There were also 2000 factories in this area with the industry land of 9.5sq.km, which accounts for 20.6% of the total area. Mixture of factory within residential area, hospital and institutional activities caused serious conflicts due to air, noise pollution and the freight delivery service between the factories. The

whole area was covered by brick and concrete but less of open/green space, which accounts for only 1.4%. In the hot summer the thermal island effect is very obvious. For long time Shanghai was of shortage of living space. The urban environment degenerated seriously.



Fig. 7. Poor Area Still Waiting for Renovation

From 1990 the population density of the whole metropolitan wide area is increased 484 to 2588 per square km, which is 3.1 times higher than Beijing, and 2.9 times higher than Tianjin.

Before jurisdiction boundary extending, the area of city proper is only 749 square km, it now covers an area of 3924 km². So the density drops from 11312 in 1990 to 3624 per square kmⁱⁱ.

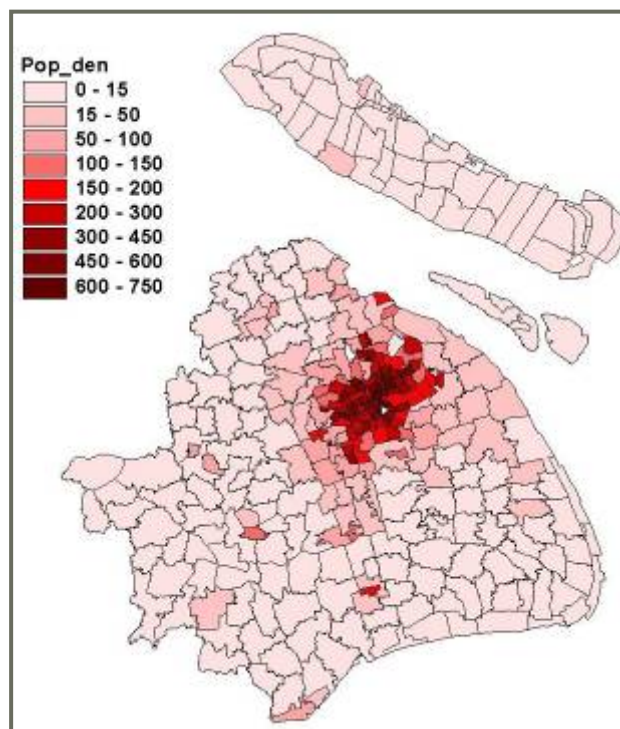


Fig. 8 Population Density in Shanghai (person/ha, 2000)

From the middle of 1990's, the central area of the city has experienced a large scale urban renewal, land leasing, removing the manufacture industry and encourage the development of service industry. Many people moved to the city fringe. During the last five years of 1990's, 470 thousand households have been re-housed. It noticed a great drop of population in the most central districts. But it is still very high comparing with the new districts.

Central area density in year 2000 and 1990

(Thousand, person/square km)

Area	2000			1990	
	Population move out	population	density	population	Density
Huangpu	363.6	574.5	46296	938.1	75592
Luwang	146.9	328.9	40859	475.8	59105
Jingan	181.3	305.3	40069	486.6	63861
New Districts		7418.2	2041		
County		2059.2	852		
Shanghai Wide		16407.7	2588	13341.9	2104

The high dense concrete urban fabric contributes to low automobile-mileage which benefits the low level of air pollution from the car. In the year 1990 43.9% of mechanized trips were made by bike. But the city also suffered the congestion, shortage of apartment for living and the lower performance efficiency, losing its advantage in competition to attract investment. For instant a travel speed survey has been taken in 1990, it showed that 34% of roads with the speed less than 10km/h. Passenger vehicle trip origins from the central area accounts for 61.2%, where the road capacity was very limited.

Comparing with the high density in the central area, land in the suburb is now well utilized. The gross population density drops to 30person/ha in 15km away from the city center.

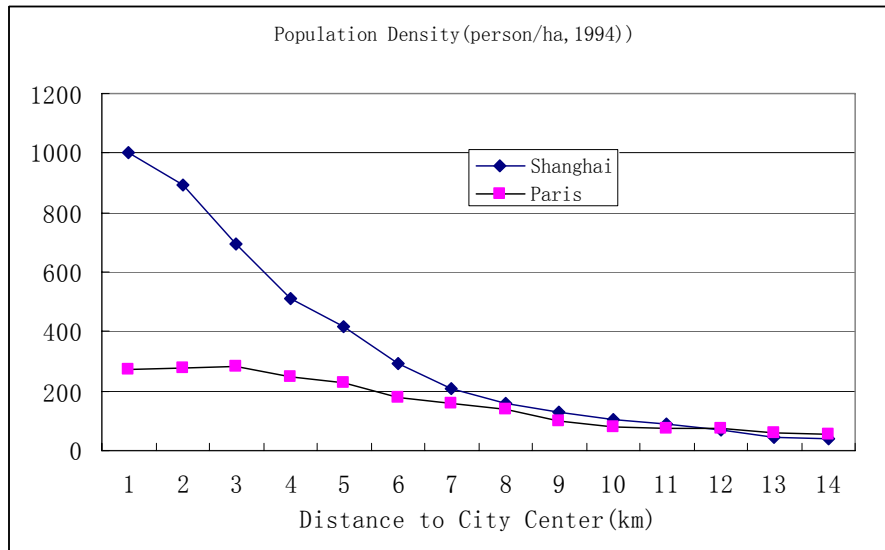


Fig.9. Density with Distanceⁱⁱⁱ

2. Urban Planning for De-centralization before 1990

To accommodate the huge demand for dynamic economic activities and the fast increasing in inflow population, the expansion of the city is inevitable. In decades Shanghai has pursued the urban planning policy to transform from a super dense, mono-centric city to a multi-centric metropolis to decentralize its population and economic activities. Due to the influence by British urban planning theory, a number of satellite towns had been planned in the Shanghai. The goal was to guide Shanghai's expansion towards Ebenezer Howard's Garden City structure while absorbing the development potential in those satellite towns, avoiding the trend of 'pancake-making' (which may be interpreted as the Chinese version of sprawl).

In 1958, to support the development of Shanghai the central government decided ten to transfer counties from Jiangsu Province to Shanghai, which provided the opportunity to decentralizing the population and factories from the central area of Shanghai. An Outline of master plan was made in 1959, in which the urban planning polices targeted at controlling the population growth in the central part of shanghai to not more than 3 million, the population in the periphery should be 1 million and there will be 2 million people staying in the seventeen satellite towns. Each of the satellite town would have the population of 100~200 thousand. Due to the shortage of land for the expansion of factories and to avoid the pollution from them in the central part of Shanghai,

720 factories with employment over 100 and 2000~3000 factories with employment less than 100 will be moved to the 10 near suburb industry area(Wusong, Yunzaobang, Pengpu, Taopu, Beixinjing, Caohejing, Changqiao, Zhoujiadu, Donggou and Gaoqiao) and to those satellite towns(Minghang, Wujing, Jiading, Anting, Songjiang, Beiyangqiao, Qingpu, Tangkou, Nanqiano, Zhoupu, Chuansha, Zhujing, Fengjing, Fengcheng, Nanhui, Chongming and Baozheng).



Fig. 10. The Shanghai Master Plan in 1959

The green belt of one to four km wide was planned between the city and near suburb to avoid the city expanded to the suburb. To leaving more space for green space and public building in the city center, the construction of high-rise apartment was encouraged. Although the influence “Great Revolution” on urban construction was very strong, this plan guided the construction of municipal facilities and industry zones in near suburban. Some large factories were settled up in Wujiang, Minghang, Anting, Jiading and Songjiang. From then on, Shanghai has been developed to a conurbation which includes industry zones in near suburban and satellite towns in far suburban.

The two huge industry constructions has also great impact on Shanghai Spatial Structure. In 1972, the petroleum chemical plant of Shanghai was built in Jingshanwei close to the Hangzhou Bay with a distance of 72 km to the city center. In 1978, Baoshan iron and steel plant was built on southern bank of Yangtz River. Both plants can use the advantage of low cost waterway transport for industry material and products. The two plants provided big

increasing in employment opportunity. To the year 1990, Baoshan and Jingshanwei became two of the biggest satellite towns in Shanghai, even though they were constructed more than ten years later than other satellite towns.

Up to 1980's, Shanghai still faced many city problems, such as confusion in land-use, lack of infrastructure, traffic congestion and lack of residential space. To guide the development of Shanghai city, in 1986<Shanghai Master Plan Outline>was approved by the State Council which is the first city master plan approved by central government. In this plan, Shanghai was definite as one of the economic, science and technology, culture centers in China as well as important international port.

In 1982, the area of Shanghai central city was 149 square kilometers. This plan put forward that total area of central city in year 2000 should be no more than 300 square kilometers. Furthermore, Shanghai should be a conurbation with convenient transport connection between central city and suburban towns. With the success of the Baoshan iron and steel plant and Jingshanwei petroleum chemical plant, the "two wing" became much more important.

Four level of city-town structure in this plan had been established. The first level is central city. There should be several zones with comprehensive functions, which could provide convenient conditions for working and living of residents. The second level is industry towns and satellite towns in near suburban, as well as 'two wings'. The third level is suburban towns. The fourth level is little rural towns. This plan put forward port and other functions should be constructed in Pudong area which has large development space. Pudong and Lujiazui should be developed to modernized city proper.

Satellite towns, located 20~40km away from city center, should have comprehensive functions. There should be convenient connections of traffic and communication between central city and satellite towns, as well as each satellite towns. There should be high-capacity and high-speed passenger transport, which could reduce the commute time to no more than one hour between central city and satellite towns as well as two wings.



Fig.11. Shanghai Master Plan(1986)

In 1990 , the central government announced the open policy for Pudong New Area. <Pudong New Area Master Plan>has been prepared which defined the two development corridors. One is North-South along the east side of Huangpu River, another is east-west from Lujiazui(the financial district) to Zhangjiang(Hi-tech Park). Pudong should be more open to the world, with multi-function, to be a modernized new area. Then several bridges ,tunnel and metro across the Huangpu River have been constructed.

Because of the poor level of infrastructure and living condition in the central part of Shanghai city, many urban constructions such as the lager scale urban reneation and infrastructure construction had been located in this area, between the year 1995 to 2000, 450thousand households have been relocated, 23million sq.m poor building has been demolished, instead of the planned satellite town. The improvement of urban living quality in central part of city, in return attract more people to stay.

From the Planning history in Shanghai, we can find that Shanghai pursued the multi-center and multi corridor spatial strategy for long time. But in fact during the fast development, the city became a bigger “Pancake”. The center of gravity for the distribution of population displaced only 100 meter. 25% of the housing build is within the inner ring, 70% of which within the out-ring which covers the land area of 642 sq.km. The only success story to receiving the growing population and providing more space for urban expansion is

the Pudong area.



Fig.12 Displacement of Population distribution Center from 1990 to 2000^{iv}

(华师大的案例)

Nevertheless, the performance of the satellite cities fell below expectations.

Statistics of Some Shanghai Satellite Towns Construction (1990)

Name	Primary Industry	Distance to Center	Land Use(Sq. km)		Population(10 thousand)		Year of Starting
			Current	Plan	Current	Plan	
Minghang	Machinery	32	20.7	60	10.65	50	1958
Wujing	Chemical	25			2.52		
Jiading	Science and Research	33	7.6	21.4	7	25	1960
Anting	Car	40	5	16.7	2.7	15	1959
Songjiang	Machine Tool / Light Industry	40	7.3	20	8.2	25	1960
Jinshanwei	Petrol Chemical	70	10	71	10	45	1972
Baoshan	Iron and Steel / Port	20	44.8	105	24	50	1983
Total			95.4	294.1	65.07	210	

3. Recent Urban Planning Policy

In May 2001 the state council approved the new master plan <shanghai city master plan (1999-2020)>. Within the plan, the vision of the Shanghai will be one of world economic center, world financial center, world trade center and world shipping center. So that according to the principle to coordinate the development of the city and its suburb, the spatial structure of Shanghai should be as following. The central city will be the principle part with multi corridor, multi-level and multi-core. Shanghai whole region will be the important component of Yangtze Delta mega-polis. The development along the river and the coast line as well as the new town in suburb has been

emphasized. It is said that the big strong development should be from the suburb and the central city should be prosperous.

From the statement in the plan we can expect the importance of development in suburb, where the new town should be the growth pillar and the service center for its surrounding area.

After Shanghai urban planning conference held in October 2003, Shanghai government issued the policy to strength the implementation of <Shanghai master plan 1999-2020> and the <Shanghai medium and short term construction scheme>. It is said that the urban layout should be with respect to the development of whole Shanghai as well as the integration with Yangtze Delta Region.



Fig.13. Major Development Corridor in Shanghai Region^v

In the central city the principle “double increase and double decrease” should be followed, which means to increase the green and open space, to decrease the building volume and FAR, in this way to optimize the spatial structure and enhance the ecological environment construction. In the suburb the construction should follow the principle of “three concentration”, which means the growth of population should be concentrated in suburb new town where there are the major transport infrastructure of highway, sea-port which will also facilitate the concentration of industry cluster to the industry park, in the meanwhile rent the land to the person who are very strong in farming. The privilege should be given to the construction of new towns, which should be with relative perfect function, good industry structure. The population of those

new towns should be over 300 thousand, to realize the scale and accumulation effect, to attract people staying. The city wide transport plan also support the spatial structure, where each important town will be connected by Urban Rail.



Fig.14. The Urban Rail Plan and Sub-City in Shanghai Region^{vi}

The urban development strategy should over not only the 600sq.km central but also extend to the 6000sq.km of the whole Shanghai region. In the suburb, the urban construction will be enhanced in three location, Ligang(Deep See-Port service industry), Songjiang (University City/export manufacture) , Anting-Jiading(Auto City). Industry development should be concentrate in several city level industry estates coving a area of 290 sq.km in suburb, which are,

1. The iron and steel industry in Baoshan,
2. Petrol chemical industry in Jingshanwei,
3. Machinery Equipment in Lingang New Town,
4. Micro-electronic industry in Pudong,
5. Automobile industry in Jiading-Anting
6. etc.



Fig.15. Shanghai Major Industry Estate

During the years of '10th Five Year Plan' , the suburb urban construction was concentrated in Songjiang New City and several suburb towns, each copies the style of a western country, for example Anting new town copies Germany style and designed by Dutch company, to be the “negative magnetic pole”against the central city. A bigger step has been put forward during the “11th Five Year Plan” period, the objective is break the segregation with the city and the suburb, leading the population increasing in the suburb towns, eliminating the “dual structure” between the city and the suburb, through a new City-town system hierarchy. According to the new spatial structure there will be,

- 1). The central city within the out-ring of 600 sq.km with the permanent population of 8.5 million;
- 2). New Town or secondary city in the suburb, Baoshan, Jiading, Qingpu, Songjiang, Minghang, Nanqiao, Jingshan, Lingangxincheng, with the total population of 5.4million, in which Songjing, Jiading and Lingangxinchen will accommodate 0.8~1.0 million people;
- 3). 60 towns with the population of 50~150thousand allocated to cover the

whole region with fundamental service facilities to support the person within a reachable distance;

4). The small village will be merged to six husbands central village, leaving more space for forest green area and agriculture activities

Demo program for the suburb town construction

In the 10th Five Year Plan of Shanghai Government, the planning of Songjinag New Town is part of Shanghai's suburban construction programme for "one city and nine town". It will be built in to a typical demonstration town to reflect the social progress of Shanghai. The Songjinag New Town will be a valuable adding to Shanghai in terms of urban function, urban structure and the culture. It covers a area of 40sq.km located 4okm from Shanghai city center adjacent to the old town of Songjiang and acts as the southwest gateway to Shanghai city. Concentrated efforts has been on the development of the New City and the core town, thus giving form and shape to this modern city-town system. This will considerably reverse the current situation of an expanding city centre and scattered suburbs, leading to the formation of an industrialized, urbanized and modernized city-town cluster, as well as an urban economic rim.



Fig. 16. Songjiang Master Plan 1990,



Fig. 17. Songjiang Master Plan 1982



Fig. 18. Songjiang Master Plan in 2002 (60sq.km)

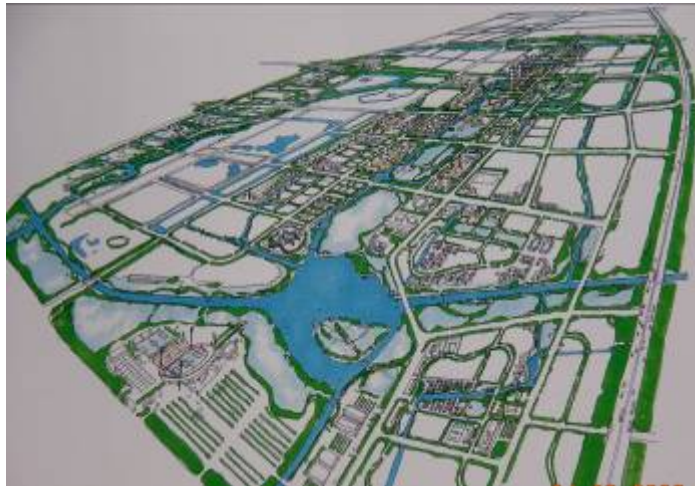


Fig. 19. Urban Design in the Central Area(by Attkins)

To collect the concept for New Town development, a competition was launched. Finally a Britain Company won the competition. The key concept elements of the proposal were quite attractive.

1). A high density central area or hub that contains principal public transport, civic service, commercial and retail facilities well connected to the rest of city by a network of transport linkage.

2). The clearing segregation of land use, Central business district, the cultural quarter, industry quarter etc.

3). Eight residential districts with arrange of community, retail, educational and leisure services and facilities provided in a district center.

4). A network of park and open space including two linear parks based on the existing waterways and a large central park which forms the focus of the central area.

It is a first in China, a university town formed by the collaboration of various universities, located in the area. It expected to have 80,000 university students and employed 20,000 academic staff.

There are also one English style residential area with a church , called Thames Town, an area of 1 square kilometer in Songjiang New Town, is Located between the residential districts in the west and the central business district of the New City.

With a single extended stretch of multi-functional path and the waterfront square serving as the main axis of the overall design, various public facilities like commercial facilities, clinic, hospital, supermarket and church are effectively congregated and buildings like detached houses, townhouses and

multi-storey apartments accommodated within the one square kilometer area. Thames Town will offer a different home to its 8,000 residents, most of whom are expected to be university professors and factory managers.



Fig.20. The Bird View of The Thames Town in Songjiang

Although the built environment is in high quality with wide road, spacious of green space, comparing with the Songjiang old town where the street is narrow, crowded with buildings, lack of green area but full of people, full of activities, the New town goes to another extreme, much more automobile dependence, less of living.



Fig.21. Landscape of Songjiang New Town



Fig.22. Landscape of Songjiang Old Town

4. The Impact of 2010 Shanghai World Expo

It is estimated that there will be more than 70 million visitors to the Expo site, which located just beside the city center, in half year. Because the transport in city center is already saturated, any small increasing in the travel demand will induce a big drop in the performance. So that the improvement in urban transport will be give first priority. It is expected that large amount of investment will be put on transport infrastructure, both within city or between cities.

Any way the most direct effect for hosting the Shanghai 2010 World Expo is to promote the rapid development of economy and trade, and tourism, and many services and related business opportunities are hard to predict. These chain effects will promote Shanghai to upgrade and optimize the industrial structure to a higher level. Three billion U.S. dollars of direct investment will be spend, which will create another leap forward in economic development in Shanghai, and triggers the development of urban agglomeration the whole Yangtze River Delta.

Secondly, Expo will have a direct role in promoting the further renewal of the old part of Shanghai city and injecting vitality to Shanghai's development. Expo site is located in the key area for urban transformation, some enterprises that cause serious pollution will be remove to other place, leaving the space for international exchanges, tourism, culture, education and other new industries. Expo will not effect image of the central city, and also will relocate enterprises and residents to the periphery of the city, which will bring a new round of regional real estate development.

Third, due to huge amount of visitor, urban infrastructure especially for urban transport will have a fundamental development. In addition to the program for urban rail transportation, Yangshan Harbor phase I, the Pudong Airport phase II, Chongming linkage, a large number of major infrastructure projects will further improve the city Urban infrastructure, greatly improving the city's traffic and transport capacity, and the public will travel more speedy and comfortable. It can be said that the Expo will be held in Shanghai will make Shanghai a world-class city. The impact of the Expo on Shanghai industry adjustment, infrastructure construction should not be underestimated.



Fig.23. The Location of the Expo Site

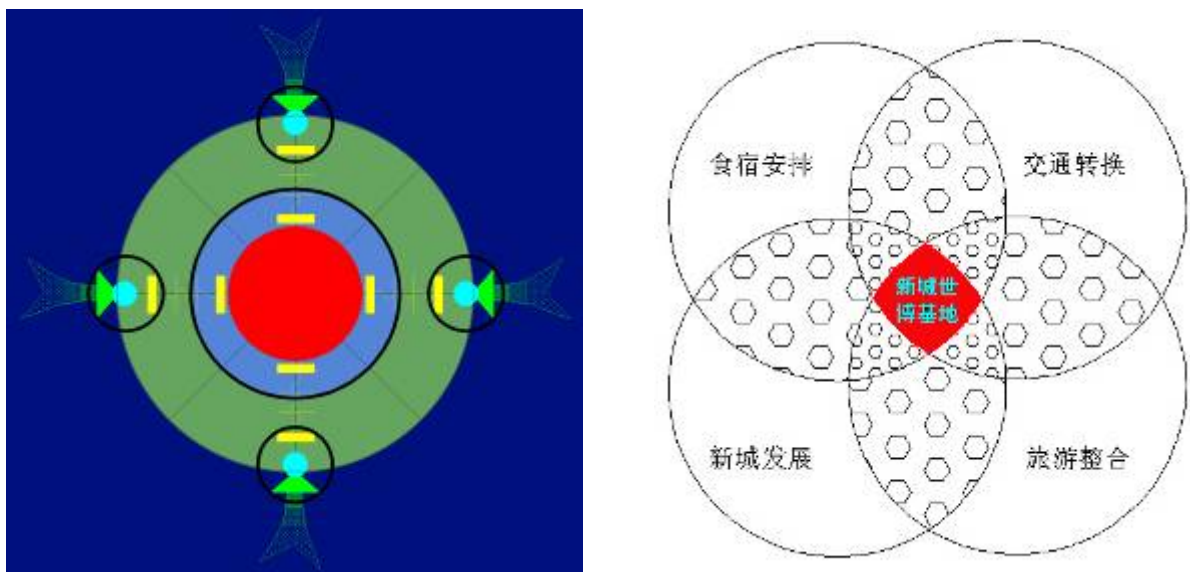


Fig. 24. The Support Function of the New Town to Expo^{vii}

The Expo effect on the restructuring of the distribution of urban space will be mainly in the following three aspects.

1).Expo factors will lead to further office business functions to gather in urban centers. Expo site is very close to the Bund and the Lujiazui area and other urban centers, the quality of the environment surrounding the site will big transformation in land use and land values will increase significantly, the trend to gather further high-grade commercial functions in the city center is very obvious. If there is not a reasonable guiding in the Shanghai whole region development, it will further increase pressure on the development in central area, aggravating the irrational distribution of urban space.

2). 2010 Shanghai World Expo factors will accelerate the enhancing development in service industries, tourism, convention and exhibition for international business, finance and insurance, information and communication, media design, logistics and transport-related services. Therefore, the demand of new space to accommodate those industries will grow rapidly. We will face big pressure in provide the space, without further increasing in urban density. To meet the demand for upgrading the city's function, to provide reasonable space for new industries, we must consider from the overall urban spatial distribution point of view. It can be said that proper guidance for office business functions to the suburb area will be needed to make a logical spatial function distribution.

3).Expo factors will further accelerate migration to the suburbs. Holding the Expo will make marked improvement in urban infrastructure, especially the central area and the suburbs, as well as transport links between Shanghai and its neighboring cities, which will be more convenient for suburban development. The transport constrains will be greatly eliminated. This factor will stimulate region's real estate development along transport corridor, and to further promote migration to suburb town. To avoid the undisciplined expansion in the previous, we need to control and guide the rational planning to form a moderate gathering, the more open and integrated spatial pattern.

It will be almost impossible to receive the vast amount of visitor from all over China or oversea. We will face the problem of hotel shortage in peak day, the shortage of garage to parking the car in central city. To avoid the difficulties, one strategy has been adopted to development the suburb town with the function of transport hub where the visitor could chose the transfer to privileged public transport system directly to the export site, with the function of a recreation center people could also enjoy themselves while staying in suburb town, the function of hotel to accommodate to the visitor at relative low rate. Obviously this strategy will greatly improve the public transport linkage between Shanghai city centres to key suburb town, and providing the recreation facilities which can be enjoyed by the people in Shanghai after the

Expo.

5. Some Comments and Suggestion

With the development gradually moved from center city to the suburbs, and how urban planning, development policy can effectively guide the process, and creating a rational layout of urban space and promote the development of urbanization in the suburbs, has become an increasingly important issue. Therefore, the following three issues will take into consideration:

1) With development emphasizing move to suburb area, the priority should be given to fast transport linkage between the city and the suburb, particularly the fast public transport, to speed up infrastructure construction in rural towns. Previous experience shows that transport has a great effect on the spread of industry and population from the city center to suburb. Improve rural infrastructure facilities; in particular to improve the urban transport infrastructure in the rural areas is to enhance the attractiveness of population and industry to suburb town.

2) The theoretical model only provides the fundamental concept of the future; the blueprint proposal will always face difficulties in implementation later on. Local culture and social facts must be taken into the consideration to develop the regional spatial strategy. Encouraging the development in suburb town may also induce the long distance travel, if without the qualified public transport service, may bring about serious congestion, even the self-contained policy can not limit the freedom of people moving around

3) Further enhance the strategy to relocate the distribution of population; a rapid/convenient transport networks and industrial park are the two key facts in creating a growth pillar for attract living, integrated business functions to support town's growth. The design of the satellite town should be multi-function to avoid the only bed town. Some service and business activities should also be encouraged to locate in the suburb town, serving as the secondary service center to towns across over Shanghai region. It is great important to adjust the dislocation of residence and employment.

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